

Long-term Trends in Nutrients and Algae in the Snake River Inflow to Brownlee Reservoir, and their Relation to In-Reservoir and Outflow Dissolved Oxygen 1995-2017.

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Idaho Power Company has monitored Snake River water quality at Brownlee Reservoir inflow since 1995. The resulting data set encompasses the development of multiple upstream Total Maximum Daily Loads (TMDLs), implementation of those TMDLs, upstream hydroelectric relicensing and a range of water years between very high and very low.

Using Weighted Regressions on Time, Discharge and Season (WRTDS) and Seasonal Mann-Kendal (SMK) statistical tests, we explored trends in the concentrations and loads of nutrients and chlorophyll-a flowing into Brownlee Reservoir, and concentrations of dissolved oxygen in the reservoir and at the outflow. During May through September, which is the focus period for the Snake River Hells Canyon TMDL, we found statistically significant ($p<0.05$) decreasing trends in Snake River inflow concentrations and loads of chlorophyll-a, total phosphorus, particulate phosphorus and organic nitrogen while dissolved ortho-phosphorus and dissolved nitrate showed increasing trends.

A primary premise of the Snake River Hells Canyon TMDL is that decreasing loads of particulate organic material, that settle and decay in Brownlee Reservoir, should result in less dissolved oxygen demand in the reservoir. We found statistically significant ($p<0.05$) increasing trends in dissolved oxygen concentrations at the Brownlee outflow during the time of year when the lowest dissolved oxygen concentrations have been observed. The dissolved oxygen deficit from saturation at the outflow was strongly, positively, related to inflowing loads of chlorophyll-a ($R^2=0.71$), organic nitrogen ($R^2=0.65$) and particulate phosphorus ($R^2=0.65$).

These relationships between nutrient and algae loads in the Snake River and dissolved oxygen in Brownlee Reservoir and its outflow support a primary premise of the Snake River Hells Canyon TMDL that improving inflowing water quality is an effective way to improve dissolved oxygen conditions in Brownlee Reservoir.